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Our ref.: P18735USPC/EHF
Christian Abel

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application serial No.:	10/568143
Inventor:	Marc H. Schneider
For:	WOOD TREATING FORMULATION
Group No.:	1792
Examiner:	Cameron
Attorney docket no.:	P18735USPC

DECLARATION UNDER 37 CFR § 1.132

I, Marc H. Schneider hereby Declare as follows:

1. I am the named inventor in the above-identified application. This declaration is submitted to establish the non-obviousness of the invention over the prior art cited in the Office Action of 06/12/2009.
2. I acknowledge that wilful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.
3. In 2007 and 2008, I performed experiments at Infinity Wood Ltd. related to the use of styrene /maleic anhydride mixtures as wood treating formulations. The following is a summary of the results of those experiments.

STYRENE-MALEIC ANHYDRIDE COPOLYMER TREATMENT TRIAL FOR WOOD (work done at Infinity Wood Ltd. in 2007 and 2008)

INTRODUCTION

Normally when polymerizing a vinyl monomer such as styrene at atmospheric pressure and moderate (up to its boiling point) temperature to improve wood properties, an initiator is needed. These initiators are usually an organic peroxide or a nitrile. Additionally, a di- or tri-functional crosslinking agent is normally added to improve machining and sanding properties. The initiators and crosslinkers are expensive and it would be good to find a treating formulation that did not require their use.

Styrene-maleic anhydride mixtures are unusual because they copolymerize spontaneously, without initiator, at about 80 °C. Since the reaction is exothermic, once started it tends to continue to completion. The styrene-maleic anhydride (SMA) copolymer formed is hard and has some amount of crosslinking because of the crosslinking potential of the maleic anhydride (MA). MA also has potential to bond to wood substance, anchoring the SMA polymer more firmly than is possible with styrene alone. Because of these attributes we tried using SMA for making modified wood using a vacuum-pressure process.

SPECIFIC METHOD USED AND RESULTS OBTAINED

Styrene monomer and MA were mixed, forming a solution. MA is a solid at room temperature and styrene a liquid. At room temperature, solubility of MA in styrene is poor, so mixing of the solution was done at about 80 °C. At first the mixture had low viscosity but its viscosity increased almost immediately. After about 5 to 10 minutes at 80 °C it was a thick gel, depending on batch size (larger batches reacted more quickly). Auto-acceleration of the reaction produced a solid polymer within 10 to 15 minutes after mixing.

Even when this mixture is mixed at elevated temperature as required for solubility and then quickly cooled to room temperature its viscosity continues to increase and it gels within a short time.

The mixing proportions used were equal parts by weight of styrene monomer and MA. When polymerizing, they copolymerize in this ratio. However, less MA can be used for different effects.

CONCLUSIONS

SMA treatments cannot be used for normal vacuum-pressure polymer modification of wood because of the high reactivity of styrene with maleic anhydride. This reactivity causes the fluid, within minutes, to become too viscous to use as an impregnation fluid.

4. The above observations are consistent with what one skilled in the art would expect when styrene is present in any mixture containing MA. Despite the above observations, the present invention provides a treating formulation in which styrene in the presence of maleic anhydride does not exhibit uncontrollable co-polymerization. It is believed that it is the order of mixing of the present invention that makes it possible to use MA and styrene together without their reacting together. Without being bound by theory, I believe that that the MA or the styrene is somehow changed so that they no longer react. I speculate that an esterification of MA with FA occurs when they are mixed together in the first solution, prior to combination with the second solution.

M. Schneider date: 2 October 2009